NATURAL GAS FED PC25C FUEL CELL POWER PLANT

FINAL REPORT FOR THE U.S. DEPARTMENT OF ENERGY

Covering Field Experience

from August 1997 to September 1998

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ABSTRACT

This report details the performances obtained during the first 14 months of operation by the Natural Gas Fed PC25C™ Power Plant installed in the city of Halle (Germany).
The Owner of the Power Plant is the Gasversorgung Sachsen Anhalt Gmbh, a company involved in the distribution of gas and water in the Sachsen Anhalt .
The power plant is operated by Hamburg Gas Consult a company located in Hamburg. This company is also involved in operations of other PC25 power plants in Germany.
Information is provided on the resulting electrical and thermal performances, reliability and Mean Time Between Failure factors and moreover an evaluation of the cost benefits.

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1. EXECUTIVE SUMMARY

The relatively small size and higher electric-to-thermal ratio of fuel cells, like the commercially available ONSI PC25 Model C^{TM} phosphoric acid fuel cell power plant, also make cogeneration a better match for several types of customers.
The PC25C power plant can be utilized “grid connect” or “grid independent” configuration however it is possible to switch from an operating mode to the other in a few seconds.
Of particular interest are “premium power” applications. In this mode the power plant normally dispatches to the grid at a full 200 KW output. However, if the grid experiences a problem, the fuel cell can reconfigure itself to support a grid independent load.

2. INTRODUCTION

Benefits of electrochemical energy conversion from PC25C phosphoric acid fuel cell power plants are:

? very low pollutant emission

? relatively high efficiency in the sub-megawatt range

? low noise and vibration

? potential for longer time between scheduled and unscheduled shutdown maintenance than engine driven system

?? ability to perform scheduled quarterly maintenance while the power plant is operating

?? high quality power

World PC25 fleet has exceeded 2 millions operating hours demonstrating the performance availability of such power plant.
PC25 power plants are installed in USA, Europe and Asia and fuels presently suitable for use by the phosphoric acid fuel cell include natural gas or propane, and hydrogen. Units have also successfully operated on municipal sewage treatment plant digester gas.
Distributing generation throughout a utility system can offer the benefits of reduced transmission and distribution cost by deferring capital expenditures for distribution system equipment and minimizing the costs of upgrading of reconditioning power lines. Under certain situation these benefits can be magnified by cogeneration (concurrent production of electric and thermal energy) at new or existing customers.

3. RESULT AND DISCUSSION

The values of the parameters indicated afterwards are related to the first 14 months starting from August 1997.

THERMAL OUTPUT

The fuel cell at GSA/EWS has the high-grade-option. That means, the cell produce heat at a low level (nearly 60°C) and at a higher level (nearly at 95°C). In the reported period the thermal output was as follows:

Low grade heat	228,1 MWh
High grade heat	204,1 MWh
Sum	432,2 MWh

ELECTRICAL OUTPUT

The produced electrical energy is used either for own demand or can delivered to the grid.

Electrical energy, delivered to the grid	74,9 MWh
Electrical energy, used for own demand	625,8 MWh
Sum	700,7 MWh

MEAN TIME BETWEEN FAILURES

The longest continuous run occur from 30.9.1997 to 8.12.1997 with 1638 h.
The reported period has 10.200 h and the fuel cell runs during this time 4.783 h. The reliability was 46,9%. This very small value came from the long stoppage between the 14.4.98 and 25.9.98, caused by the damaged cell stack. In this time, the fuel cell was transported to Italy and repaired at CLC.

Mean Time Between Failure = 368 hours

COST BENEFITS

For the fuel cell project of GSA/EWS the costs are the following:

Non recurring costs = (Fuel cell power plant foundation, costs for planning....)	2.100.000 DM
Operating costs =	149.056 DM
Heat benefit =	27.213 DM
Benefit by self-supply with electrical energy =	105.134 DM
Benefit by delivered electrical energy =	11.746 DM

The total cost benefit without non recurring costs is -4.963 DM

A negative benefit means uneconomical fuel cell working.

4. CERTIFICATION

CLC S.r.l. and Gasversorgung Sachsen Anhalt Gmbh certify that it has complied in all respects with the grant under DE-FG21-96MC33361, Climate Change Fuel Cell Program and that the related efforts required by that grant are now fully complete including twelve months of operation and submission of the Final Report herein supplied. Such report is in compliance with Paragraph 4 of DoE's Special Terms and Conditions for Research Projects Grants for Climate Change Fuel Cell Program.

5. CONCLUSIONS

Particularly promising applications are:

- Hospitals and health care facilities and generally the buildings having favorable thermal recovery potentials and where at least some importance is attached to power quality and reliability.

- Selected or isolated locations having grid capability constraints where long, expensive, or time-consuming capacity upgrades are otherwise required.

- Data centers, communication facilities, and manufacturing plants where power quality and grid reliability are of particular concern.

For these reasons, dispersed generation locations at hospitals, computer centers, and the like are considered to be attractive market entry prospects for fuel cells. One mode of this application would be a premium power configuration where the fuel cell dispatches a full 200 KW to the grid during normal periods, and reverts to a grid independent supply for local customer loads during any grid interruption.